

3D imaging of damage in biaxially loaded composites at cryogenic temperatures using a novel micro-CT experiment

Completed Technology Project (2016 - 2020)



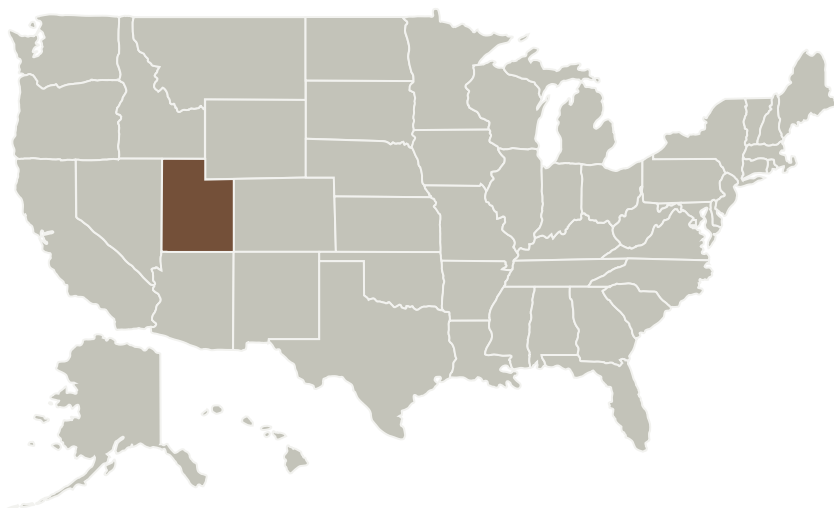
Project Introduction

The goal of this project is to provide an unprecedented insight into ply-level initiation and evolution of damage in composite materials subjected to extreme aerospace-type loading environments. Specifically, a novel apparatus will be developed to enable in situ X-ray computed tomography (CT) 3D imaging of biaxially stressed thin-ply composite specimen exposed to cryogenic temperatures of liquid nitrogen. The high-resolution, 3D image data obtained from this experiment will have a tremendous impact on the overall understanding of ply- and constituent-level composite materials failure under realistic loading conditions. Moreover, the data from this study will be invaluable for development and validation of current and future progressive damage models that will enhance our ability to predict failure and structural life of a wide range of composite structures. In the NASA Technology Roadmap, TA12, section 2 states the current challenge of structural reliability and sustainment is developing a more exhaustive understanding of the mechanisms for damage initiation and propagation in composite structures. The following research plans' novel approach and method of in situ (i.e. while being tested) visualization of structural failure aims to fulfill this objective, and if successful, will lead to unprecedented advances in composite design and validation of laminate failure theories.

Anticipated Benefits

If successful, the research will lead to unprecedented advances in composite design and validation of laminate failure theories.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
University of Utah	Lead Organization	Academia	Salt Lake City, Utah

Primary U.S. Work Locations
Utah

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

University of Utah

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:

Hung D Nguyen

Principal Investigator:

Michael W Czabaj

Co-Investigator:

Jordan French

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Technology Maturity (TRL)

Start: 2
Current: 2
Estimated End: 3



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
 - └ TX12.1 Materials
 - └ TX12.1.1 Lightweight Structural Materials

Target Destination

Foundational Knowledge